

Registration of SJ-U86 Cotton Germplasm Line with High Yield and Excellent Fiber Quality

The cotton (*Gossypium hirsutum* L.) germplasm line SJ-U86 (Reg. no. GP-868; PI 642414 and NSSL 441398.01) was developed by USDA-ARS and Cotton Incorporated, and jointly released with the University of California in 2006. This line possesses superior lint yield, fiber length, and competitive fiber strength under heat stress environments compared with Acala cottons of California. For public and private breeders in the far west, especially in California, SJ-U86 provides an alternative source for improving heat tolerance in Acala cottons because of its excellent yield and fiber characteristics.

SJ-U86 line originated from the cross of commercial cultivars FiberMax 958 and SG 248. The pedigree of FiberMax 958 is CS6S/'Siokra S-324'/'Sicala V-1' and the pedigree of SG 248 is Mo 89-117/'DP 5415' (Bowman et al., 2006). The cultivar SG 248 yields well in heat stress environments. The cultivar FiberMax958 has relatively moderate yields under high temperature conditions in the far west USA but has very good fiber quality characteristics. Individual plants were selected for fruit retention in a heat stress environment in the F_2 and F_3 generations at Maricopa, AZ, in 2001 and 2002. Fiber samples from these plants were analyzed by HVI at the Fiber Quality Laboratory, Cotton Inc, Cary, NC. A total of 70 $F_{3,4}$ lines were advanced for F_4 progeny row evaluation in non-replicated tests at Shafter, CA, Maricopa, AZ, and Tifton, GA in 2003. From these tests, 14 lines were recommended for further testing. In 2004, the F_5 lines were planted in replicated tests at Shafter, CA, Maricopa, AZ, and Tifton, GA. Strain SJ-U86, one of the 14 advanced lines, was selected for release on the basis of superior overall agronomic performance and fiber quality in these tests, primarily in California but also across locations.

The replicated trials in 2004 included the parent cultivars FiberMax 958 and SG 248; two check cultivars PhytoGen 72 and CPCSD Maxxa; and AGC375 (Percy et al., 2006), a recent germplasm release from USDA-ARS and Cotton Incorporated derived from the same cross as SJ-U86. FiberMax 958, and Acala cottons PhytoGen 72 and Maxxa, were included in the trials as high fiber quality checks. In addition, PhytoGen 72 was included as a high yield performance check for California. Across locations, SJ-U86 yielded (1960 kg ha^{-1}) significantly better ($P < 0.05$) than the two check cultivars PhytoGen 72 (1467 kg ha^{-1}) and Maxxa (1207 kg ha^{-1}) and its parents FiberMax 958 (1652 kg ha^{-1}) and SG 248 (1791 kg ha^{-1}) ($\text{LSD} = 166 \text{ kg ha}^{-1}$). SJ-U86 consistently yielded better at the three sites, ranked the best yielder at California (2219 kg ha^{-1}) and Georgia (1671 kg ha^{-1}), and was statistically equivalent to the best yielding entry in Arizona (SG 248 with 2071 kg ha^{-1}). Lint yield of SJ-U86 in California exceeded that of the PhytoGen 72 by 16% and Maxxa by 28%. Lint percent of SJ-U86 exceeded 41% at all locations and exceeded 44% in California on replicated 15.24-m (50-foot) plot size. In California, SJ-U86 (44.1%) was significantly better than PhytoGen 72 (41.2%) and similar to Maxxa (43.6%) ($\text{LSD} = 1.1\%$). The yield of SJ-U86 (2219 kg ha^{-1}) at Shafter, CA, was better than cultivars PhytoGen 72 (1907 kg ha^{-1}), and significantly better than Maxxa (1746 kg ha^{-1}), and its parents, FiberMax 958 (1708 kg ha^{-1}) and SG 248 (1712 kg ha^{-1}) ($\text{LSD} = 420 \text{ kg ha}^{-1}$).

Fiber lengths (UHM) of SJ-U86 (29.4 mm) were superior to that of the FiberMax 958 parent (28.7 mm) when averaged across locations ($\text{LSD} = 0.65 \text{ mm}$). The upper quartile fiber length provided by the Advanced Fiber Information System (AFIS) for SJ-U86 (32.4 mm) was superior to that of the Acala cultivars, PhytoGen 72 (31.8 mm) and Maxxa (31.0 mm) ($\text{LSD} = 0.65$). Fiber length uniformity of SJ-U86 (82.9%) was compar-

able to that of FiberMax 958 (82.5%) and Acala cultivars PhytoGen 72 (83.5%) and Maxxa (83.5%). Most notably, SJ-U86 had significantly greater fiber bundle strength $340.0 \text{ kN m kg}^{-1}$ than either of its parents, FiberMax ($320.0 \text{ kN m kg}^{-1}$) and SG 248 ($318.0 \text{ kN m kg}^{-1}$), and similar to PhytoGen 72 ($347.0 \text{ kN m kg}^{-1}$) and Maxxa ($340.0 \text{ kN m kg}^{-1}$) ($\text{LSD} = 10.7 \text{ kN m kg}^{-1}$). The micronaire reading of SJ-U86 (5.0) was significantly lower than that of FiberMax 958 (5.3) or PhytoGen 72 (5.3) ($\text{LSD} = 0.15$). Fiber fineness (AFIS) of SJ-U86 (178 mtex) was lower than that of FiberMax 958 (181 mtex) and the same as PhytoGen 72 (178 mtex) ($\text{LSD} = 3.5$). The overall quality of SJ-U86 fiber was also equal to or better than that of traditional Acala cultivars grown as checks.

SJ-U86 was also entered into the University of California non-Approved Upland trials in 2004 at two locations, Shafter and the West Side Field Stations. In these independent trials, it was again compared with the check cultivars PhytoGen 72 (2102 kg ha^{-1}) and Maxxa (1841 kg ha^{-1}) and with the recent release AGC 375 (2169 kg ha^{-1}) ($\text{LSD} = 164 \text{ kg ha}^{-1}$). Averaged across locations, lint yield of SJ-U86 (2416 kg ha^{-1}) in these tests exceeded that of the average across check varieties by 23% and that of AGC 375 by 11%. For lint percent, SJ-U86 (41.0%) was significantly better than PhytoGen 72 (38.4%) and similar to Maxxa (41.5%) ($\text{LSD} = 0.7\%$). Again, HVI fiber quality matched that of the Acala check varieties. Fiber lengths (UHM) of SJ-U86 (29.8 mm) were superior to that of Maxxa (29.0 mm) and similar to PhytoGen 72 (30.5 mm) when averaged across locations ($\text{LSD} = 0.6 \text{ mm}$). Fiber length uniformity of SJ-U86 (83.0%) was comparable to that of Acala cultivars PhytoGen 72 (82.8%) and Maxxa (82.5%). Most notably, SJ-U86 ($346.0 \text{ kN m kg}^{-1}$) had significantly better fiber bundle strength than Acala Maxxa ($334.0 \text{ kN m kg}^{-1}$) and similar to PhytoGen 72 ($348.0 \text{ kN m kg}^{-1}$) ($\text{LSD} = 8.0$). The Micronaire value of SJ-U86 (4.3) was significantly lower than that of PhytoGen 72 (4.7) and similar to Maxxa (4.4) ($\text{LSD} = 0.25$).

The primary reason for the release of the SJ-U86 line as an alternative germplasm choice is its significantly higher lint yield and higher lint percent when compared with those of well-known Acala high-quality cottons, with no overall sacrifice of fiber quality. In addition to its superior performance in the San Joaquin Valley of California, SJ-U86 (1989 kg ha^{-1}) performs much better in the heat stress environment of Maricopa, AZ, where Acala cultivars Maxxa (1363 kg ha^{-1}) and PhytoGen 72 (1583 kg ha^{-1}) yield poorly ($\text{LSD} = 200 \text{ kg ha}^{-1}$). In the hot environment of Maricopa, SJ-U86 yields slightly less than its heat-tolerant parent, SG 248 (2071 kg ha^{-1}), but with significant improvement in almost all fiber quality traits. This combination of heat resistance similar to SG 248 with fiber quality that matches Maxxa and PhytoGen 72 suggests that SJ-U86 could be a source of improved heat resistance for California cottons. It might also serve as a source of improved fiber quality for heat stressed environments such as the low deserts of Arizona.

Small quantities of seed (25–50 g) are available to cotton breeders, geneticists, and other research personnel on written request to the corresponding author or R.G. Cantrell, and will remain available for at least 5 yr. Requests for seed from outside the USA must be accompanied by an import permit allowing entry into the requestor's country. The USDA-ARS and Cotton Incorporated may not be able to certify that seed is free of certain insects or pathogens specified on import permits, and in such cases seed cannot be supplied. It is requested that appropriate recognition of the source be given when these germplasm lines contribute to the development of a new breeding line, hybrid, or cultivar. Genetic material of this release will be deposited in the National Plant Germplasm

System where it will be available after 5 yr for research purposes, including development and commercialization of new cultivars.

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